

Appl. No. 10/706,644
Amendment and Response dated January 10, 2007
Reply to Final Office Action of November 15, 2006

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Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

- 1-16. (Canceled)
17. (Currently amended) A process for producing synthesis gas comprising:
converting at least a portion of a feedstream comprising a hydrocarbon-containing gas and an atomic oxygen-containing gas over a syngas catalyst, under operating conditions comprising a pressure ~~of at least~~ greater than or equal to 2 atmospheres, said operating conditions being effective to produce a gas stream comprising hydrogen and carbon monoxide, with a carbon monoxide selectivity equal to or greater than 80 % after at least 48 hours of operation,
wherein the syngas catalyst comprises a metal catalyst material comprising a rhodium alloy comprised of rhodium and at least one second metal selected from the group consisting of ruthenium, rhenium, niobium, tantalum and mixtures thereof, and wherein the rhodium alloy is substantially free of nickel.
18. (Previously presented) The process according to claim 17 wherein the at least one second metal in the rhodium alloy comprises rhenium.
19. (Previously presented) The process according to claim 17 wherein the at least one second metal in the rhodium alloy comprises ruthenium.
20. (Canceled)
21. (Original) The process according to claim 17 wherein the rhodium alloy increases the melting point of the metal catalyst material to a temperature above 1964°C.
22. (Original) The process according to claim 17 wherein the hydrocarbon-containing gas

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comprises methane or natural gas.

23. (Original) The process according to claim 17 wherein the atomic oxygen-containing gas comprises diatomic oxygen, water, carbon dioxide, and combinations thereof.

24. (Original) The process according to claim 17 wherein the atomic oxygen-containing gas comprises diatomic oxygen.

25. (Original) The process according to claim 17 wherein the conversion step comprises partial oxidation, steam reforming, dry reforming, oxidative dehydrogenation, or combinations over said syngas catalyst.

26. (Original) The process according to claim 17 wherein the process exhibits a hydrocarbon conversion equal to or greater than 80 %, and a hydrogen selectivity equal to or greater than 80 %, after at least 48 hours under operating conditions of at least greater than or equal to 2 atmospheres.

27. (Original) The process according to claim 17 wherein the process exhibits a hydrocarbon conversion equal to or greater than 85 %, and a hydrogen selectivity equal to or greater than 85 %, after at least 48 hours under operating conditions of at least greater than or equal to 2 atmospheres.

28-38. (Canceled)

39. (Previously presented) The process according to claim 17 wherein the catalyst comprises from about 1 percent to about 10 percent of the second metal by weight of the catalyst; and between 1 and 10 percent of rhodium by weight of the catalyst.

40. (Previously presented) The process according to claim 17 wherein the catalyst comprises from about 2 percent to about 8 percent of the second metal by weight of the catalyst.

41. (Previously presented) The process according to claim 17 wherein the catalyst comprises from about 2 percent to about 8 percent of rhodium by weight of the catalyst.

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42. (Currently amended) The process according to claim 17 wherein the at least one second metal in the rhodium alloy further comprises a metal selected from the group consisting of tungsten, ~~niobium, tantalum,~~ zirconium and mixtures thereof.
43. (Previously presented) The process according to claim 17 wherein the rhodium alloy comprises a second metal selected from the group consisting of ruthenium, rhenium and mixtures thereof.
44. (Previously presented) The process according to claim 17 wherein the rhodium alloy is supported by a refractory support comprising a material selected from the group consisting of modified alumina, partially-stabilized alumina, unmodified alumina, modified zirconia, partially-stabilized zirconia, unmodified zirconia, titania, and combinations thereof.
45. (Previously presented) The process according to claim 44 wherein said refractory support comprises a material selected from the group consisting of modified alumina, zirconia, and combinations thereof.
46. (Previously presented) The process according to claim 44 wherein said refractory support comprises a material selected from the group consisting of modified alumina, partially-stabilized alumina, unmodified alumina, and combinations thereof.
47. (Previously presented) The process according to claim 46 wherein the catalyst has a metal surface area per gram of catalyst from 0.62 square meter per gram of catalyst to 5.7 square meter per gram of catalyst.
48. (Previously presented) The process according to claim 17 wherein the metal catalyst material further comprises at least one promoter, said promoter comprising an element selected from the group consisting of lanthanide metals, alkali earth metals, and combinations thereof.
49. (Canceled)
50. (Previously presented) The process according to claim 48 wherein said promoter

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comprises one element selected from the group consisting of La, Ce, Pr, Nd, Pm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, their corresponding oxides, their corresponding ions, and mixtures thereof.

51. (Previously presented) The process according to claim 48 wherein said promoter comprises samarium.

52. (Previously presented) The process according to claim 17 wherein the process further exhibits a hydrogen selectivity equal to or greater than 80 %, after at least 48 hours under said operating conditions of at least greater than or equal to 2 atmospheres.

53. (Previously presented) The process according to claim 17 wherein the process exhibits a carbon monoxide selectivity equal to or greater than 85 %, and a hydrogen selectivity equal to or greater than 85 %, after at least 48 hours under operating conditions of at least greater than or equal to 2 atmospheres.

54. (Previously presented) The process according to claim 25 wherein the conversion step comprises partial oxidation over said syngas catalyst.

55. (Previously presented) The process according to claim 17 wherein the gas stream comprising hydrogen and carbon monoxide is further reacted in a synthesis reactor under conditions effective to produce liquid hydrocarbons.

56. (Currently amended) A process for producing synthesis gas comprising:
converting at least a portion of a feedstream comprising a hydrocarbon-containing gas and an atomic oxygen-containing gas over a syngas catalyst, under conditions effective to produce a gas stream comprising hydrogen and carbon monoxide,
wherein the syngas catalyst comprises a metal catalyst material comprising a rhodium alloy comprised of rhodium and at least one second metal selected from the group consisting of ruthenium, ~~iridium~~, rhenium, and mixtures thereof,
wherein said rhodium alloy is substantially free of nickel;
wherein the rhodium alloy is supported by a modified alumina support; and
further

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wherein the process exhibits a hydrocarbon conversion equal to or greater than 80 %, a carbon monoxide selectivity equal to or greater than 80 %, and a hydrogen selectivity equal to or greater than 80 %, after at least 48 hours under operating conditions comprising a pressure of at least greater than or equal to 2 atmospheres.

57. (Previously presented) The process according to claim 56 wherein said modified alumina is modified with a modifying agent selected from the group consisting of aluminum, rare earth metals, alkali earth metals, transition metals, and combinations thereof.

58. (Previously presented) The process according to claim 56 wherein said modified alumina is modified with a modifying agent selected from the group consisting of lanthanum, magnesium, aluminum, and combinations thereof.

59. (Currently amended) The process according to claim 56 wherein the rhodium alloy comprises rhodium ~~a second metal selected from the group consisting of ruthenium, rhodium and mixtures thereof.~~

60. (Previously presented) The process according to claim 56 wherein the rhodium alloy comprises ruthenium.

61. (Previously presented) The process according to claim 56 wherein the catalyst has a metal surface area equal to or greater than 0.8 square meter of metal per gram of catalyst.

62. (Previously presented) The process according to claim 56 wherein the catalyst has a metal surface area per gram of catalyst from 0.8 square meter of metal per gram of catalyst to 5.7 square meter of metal per gram of catalyst.

63. (Previously presented) The process according to claim 56 wherein the catalyst has a metal surface area per gram of metal from 7.7 square meter of metal per gram of metal and 16.7 square meter of metal per gram of metal.

64. (Previously presented) The process according to claim 56 wherein the catalyst has a metal

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dispersion between 3.7 % and 16.2 %.

65. (Previously presented) The process according to claim 56 wherein the support is in the shape of discrete structures having a maximum characteristic dimension from about 0.25 mm to 6.25 mm.

66. (Previously presented) The process according to claim 17 wherein the rhodium alloy is supported by a refractory support comprising a material selected from the group consisting of modified alumina and partially-stabilized alumina, said modified alumina being modified with a modifying agent selected from the group consisting of aluminum, rare earth metals, alkali earth metals, transition metals, and combinations thereof.

67. (Previously presented) The process according to claim 66 wherein said modified alumina is modified with a modifying agent selected from the group consisting of lanthanum, magnesium, aluminum, and combinations thereof.